VI. *An Account of ſome new Electrical Experiments.* *By Mr.* Tiberius Cavallo: *communicated by Mr.* Henley, *F. R. S.*

DESCRIPTION AND USE OF THE ATMOSPHERICAL ELECTROMETER.

Read Dec. 19, 1776.

FIG. I. repreſents a very ſimple inſtrument, which I have contrived for making obſervations on the electricity of the atmoſphere, and which on ſeveral accounts ſeems to be the moſt uſeful inſtrument hitherto invented for that purpoſe. AB is a common jointed fiſhing-rod, without the laſt or ſmalleſt joint. From the extremity of this rod proceeds a ſlender glaſs tube C, covered with ſealing-wax, and having a cork D at its end, from which a pith-ball electrometer is ſuſpended. HGI is a piece of twine faſtened to the other extremity of the rod, and ſupported at G by a ſmall ſtring FG. At the end I of the twine a pin is faſtened, which, when puſhed into the cork D, renders the electrometer E uninſulated.

When

When I intend to obſerve the electricity of the atmoſphere with this inſtrument, I thruſt the pin I into the cork D, and holding the rod by its lower end A, project it out of a window in the upper part of the houſe, into the air, raiſing the end of the rod with the electrometer ſo as to make an angle of about 50° or 60° with the horizon. In this ſituation I keep the inſtrument for a few ſeconds, and then pulling the twine at H, I diſengage the pin from the cork D, which operation cauſes the ſtring to drop in the dotted ſituation LK, and leaves the electrometer inſulated, and electrified with an electricity contrary to that of the atmoſphere. This done, I withdraw the inſtrument, and examine the quality of the electricity without any obſtruction either from wind or darkneſs.

With this inſtrument I have made obſervations on the electricity of the atmoſphere ſeveral times in a day, and have kept a journal of thoſe experiments from the 27th of September laſt to this day.

The following is the moſt remarkable part of the above-mentioned journal, in which I have noted the electricity of the electrometer, that is the contrary of that in the atmoſphere.

The ſtroke —— ſignifies *as above.*

Time of Obſervation.	Clouds.	Fog.	Wind.	Opening of the Electrometer in inches.	Electricity.
Oct. 19th, 10½ o'clock.	Cloudy.	Very little at a diſtance.	Very ſtrong.	$\frac{1}{10}$	Negative.
11	—	—	—	—	—
2	Heavy clouds.	—	Violent.	$\frac{3}{4}$	Poſitive.
2¼	Leſs cloudy.	—	Little.	1	—
3	Few at a diſtance.	—	—	$\frac{1}{2}$	Negative.
8	o	o	—	—	—
Oct. 31ſt, 11 poſt mer.	—	—	o	$\frac{1}{2}$	—
Nov. 6th, 11 poſt mer.		Very thick.	—	1	—

From the above-mentioned journal I have deduced the following general obſervations.

1ſt, That there is in the atmoſphere at all times a quantity of electricity; for whenever I uſe the above deſcribed atmoſpherical electrometer it always acquires ſome electricity.

2dly, That the electricity of the atmoſphere or fogs is always of the ſame kind, namely poſitive; for the electrometer is always negative, except when it is evidently influenced by heavy clouds near the zenith.

3dly, That the ſtrongeſt electricity is obſervable in thick fogs, and the weakeſt when the weather is cloudy and there is a ſtrong appearance of rain; but it does not ſeem to be leſs at night than in the day-time.

DESCRIP-

DESCRIPTION OF THE ELECTROMETER FOR THE RAIN.

THE rain-electrometer is, in its principle, nothing more than an inſulated inſtrument to catch the rain, and by a pith-ball electrometer to ſhow the quantity and quality of its electricity.

Fig. 2. repreſents an inſtrument of this kind, which I have frequently uſed, and after ſeveral obſervations have found to anſwer very well. ABCI is a ſtrong glaſs tube about two feet and a half long, having a tin funnel DE cemented to its extremity, which funnel defends part of the tube from the rain. The outſide ſurface of the tube from A to B is covered with ſealing-wax, as alſo that part of it which is covered by the funnel. FD is a piece of cane, round which ſeveral braſs wires are twiſted in different directions, ſo as to catch the rain eaſily, and at the ſame time to make no reſiſtance to the wind. This piece of cane is fixed into the tube, and a ſlender wire proceeding from the former goes through the bore of the tube, and communicates with the ſtrong wire AG, which is thruſt into a piece of cork faſtened to the end A of the tube. The end G of the wire AG is formed into a ring, from

which I ſuſpend a more or leſs ſenſible pith-ball electrometer as occaſion requires.

This inſtrument is faſtened to the ſide of the window-frame, where it is ſupported by ſtrong braſs hooks at CB. The part H ſtands out of the window, with the end F a little elevated above the horizon. The remaining part of the inſtrument paſſes, through a hole in a glaſs of the ſaſh, into the room, and no more of it touches the ſide of the window than the part BC.

When it rains, eſpecially in flying ſhowers, this inſtrument, ſtanding in the ſituation above deſcribed, is frequently electrified; and by the diverging of the electrometer the quantity and quality of the electricity of the rain may be obſerved, without any danger of miſtake. With this inſtrument I have obſerved that the rain is generally electrified negatively, and ſometimes ſo ſtrongly, that I have been able to charge a ſmall coated phial at the wire AG.

This rain-electrometer ſhould be fixed in ſuch a manner that it may be eaſily taken from and replaced at the window as occaſion may require; for it will be neceſſary to clean it very often, particularly when a ſhower of rain is approaching.

EXPERI-

EXPERIMENTS MADE WITH A GLASS TUBE HERMETICALLY SEALED, AND HAVING SOME QUICKSILVER INCLOSED IN ITS CAVITY.

IN making ſome experiments rather foreign to electricity, it occurred to me, that when I agitated ſome quickſilver in a glaſs tube hermetically ſealed, and in which the air was very much rarefied, it contracted a very ſenſible quantity of electricity; which however was not conſtant, nor, as I firſt thought, in proportion to the agitation of the quickſilver. Being deſirous of aſcertaining the properties of this tube, I conſtructed ſeveral of them, and, as accurately as I could, obſerved their properties; but as they all agreed with regard to the chief points, I ſhall only deſcribe one, which is the beſt I have yet made.

This tube is two feet and ſeven inches long, and about four tenths of an inch in diameter: the quickſilver in it may be about three quarters of an ounce, and to exhauſt it of air, I cloſed it whilſt the quickſilver was boiling in its oppoſite end.

Before I uſe this inſtrument I warm it a little and clean it; then holding it nearly horizontally, I let the quickſilver in it run from one end of the tube to the other,

other, by gently and alternately elevating and depreſſing its extremities. This operation immediately renders the outſide of the tube electrical, but with the following remarkable property, *viz.* that part or end of the tube where the quickſilver actually ſtands is poſitive, and the remaining part negative. If, by elevating this poſitive end of the tube a little, I let the quickſilver run to the oppoſite end which was negative, then the former inſtantly becomes negative and the latter poſitive. The poſitive end is always more ſtrongly electrical than the negative. If when one end of the tube (which we call A) is poſitive, that is, if, when the quickſilver is in it, I do not take off the electricity; then on elevating it ſo as to let the quickſilver run to the oppoſite end B, the end A becomes negatively electrified in a very ſmall degree: if I make it poſitive a ſecond time, and do not take off that poſitive electricity; then, on elevating it again, it appears to be poſitive in a ſmall degree: but if whilſt it is poſitive I take off that poſitive electricity, then on being elevated it appears ſtrongly negative.

Theſe appearances I would explain in the following manner: the quickſilver agitated within the cavity of the tube acts like a rubber, that is, excites the inſide ſurface of the tube poſitively, and becomes itſelf negative. Now when the quickſilver, negatively electrified, is on one

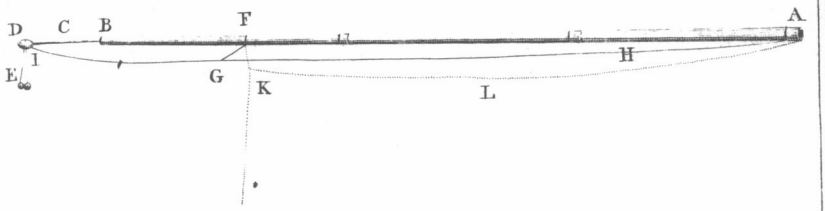
end of the tube, the outſide of the glaſs, by the known property of charged electrics, muſt be poſitive. The remaining part of the tube being poſitive on its inner ſurface, muſt be negative on the outſide. But as there is a *vacuum* within the tube, it may be aſked, why is not the equilibrium between the negative electricity of the quickſilver and the poſitive electricity of the glaſs inſtantly balanced?

When about two inches of each extremity of this tube are coated with tin-foil, that coating aſſiſts to make the electricities more conſpicuous.

With regard to the conſtruction of ſuch tubes (which I have made of ſeveral lengths from nine inches to two feet ſeven inches) I find that ſome will act very well, while others will hardly acquire any electricity at all, even when they are made very hot. I am not as yet thoroughly ſatisfied with reſpect to the cauſe of this difference, but ſuſpect that the thickneſs of the glaſs is more concerned in it than any thing elſe; for I find that a tube whoſe glaſs is about one twentieth of an inch thick, anſwers better than either a thicker or a thinner one.

November 13, 1776.

Fig. 1.



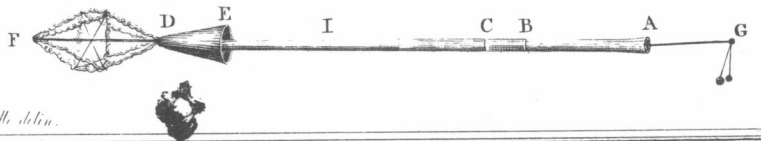


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Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

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